



GRUMMAN GUN TURRET

by Chuck Hansen

Only three American aircraft companies produced turrets for their own airplanes during World War II: the Glenn L. Martin Airplane Co., the Consolidated Aircraft Corp., and Grumman. Of these three, only Martin turrets were installed on planes built by producers other than Martin (Martin and Consolidated turrets are described in other chapters).

DEVELOPMENT—Grumman's sole turret, the 150SE, was designed, built and modified in conjunction with the design and production of the Grumman TBF *Avenger* torpedo bomber. It was the first electrically driven turret to be installed on an American naval aircraft, and it was also one of the first turrets installed on a production aircraft in the United States. The hand-built prototype model (the X150SE-1) was purchased in May 1940 as part of the XTBF-1 contract. Mass production of the turret began in mid-1942. About 10,000 units were finally built, in both 150SE-1 and -2 models, most on subcontracts from Grumman and the General Motors Corp. to the Emerson Electric Mfg. Co. in St. Louis and the Sampson United Corp. of Rochester, N.Y. Between June 1942 and June

1945, Emerson built 5,724 Model 150SE-2 turrets at its St. Louis plant, for both Grumman and GMC (GM was building TBFs—as TBMs—in Maryland).

In the late 1930s, it was widely believed that an efficient, well-armored aircraft turret could not be made light enough for installation aboard a carrier-based airplane, and most naval dive and torpedo bombers were defended by hand-held .30-caliber guns in rear gunners' cockpits. Besides having the drawbacks of hand-held weapons in high-speed aircraft, these guns usually could not be brought to bear to fire forward. As part of the XTBF-1 design contract of April 1940, Grumman engineers proposed a radically new turret that carried a single .50-caliber machine gun with a full 360° field of fire.

Some thought had been given to using a British-designed Boulton-Paul turret with hydraulic azimuth and elevation drives, but this design was dropped due to its high vulnerability to disabling battle damage. An electric amplidyne drive was developed (by the General Electric Co. in Schenectady, N.Y.) which was compact and simple, though somewhat heavier than the British hydraulic drive. The entire drive

Grumman turret mounted atop truckbed at NAS San Diego, 1944. Escape hatch has been removed. Note (nonstandard) telescopic sight. (NA 80-G-242366)

unit weighed 143 lbs. (the total turret weight—including gun, ammunition, drive, gun accessories, and armorplate and glass—was substantially higher, between 550 and 600 lbs., when carrying a gunner and a full ammunition load).

Although there were some minor developmental problems, the 150SE performed well in service and paved the way for other aircraft turrets installed on many subsequent wartime and post-war carrier-based attack aircraft.

DESCRIPTION—The 150SE was unique in many ways. Although it was an upper (deck) turret, the turret dome was neither hemispherical nor squared off, but instead had side panels sloped to match the contour of the long glazed "greenhouse" canopy forward of the turret. One of these sloping panels was completely removable to provide emergency egress. An additional feature of this escape panel was a quadrant of Plexiglas which could be opened for ventilation.

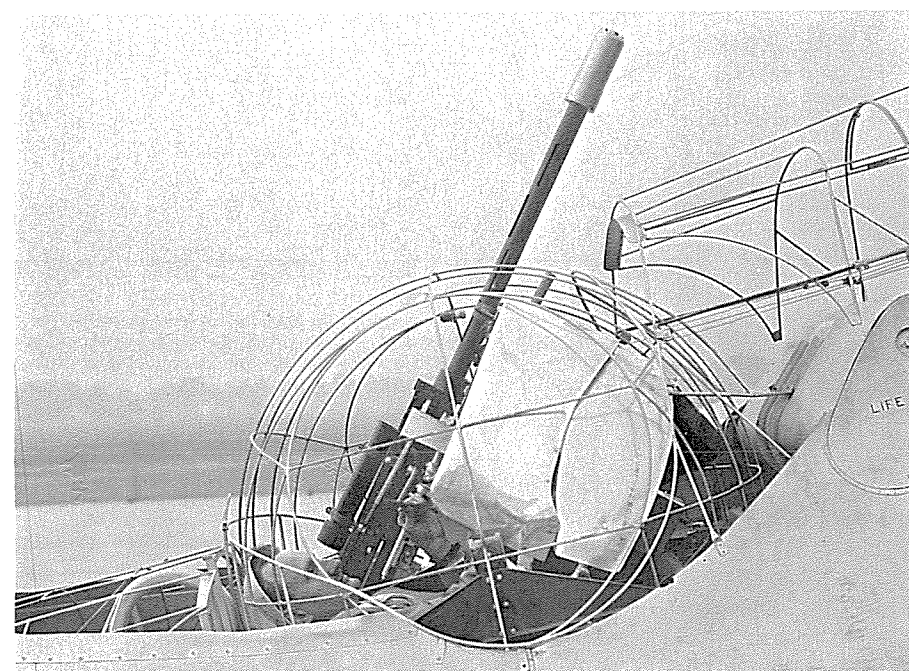
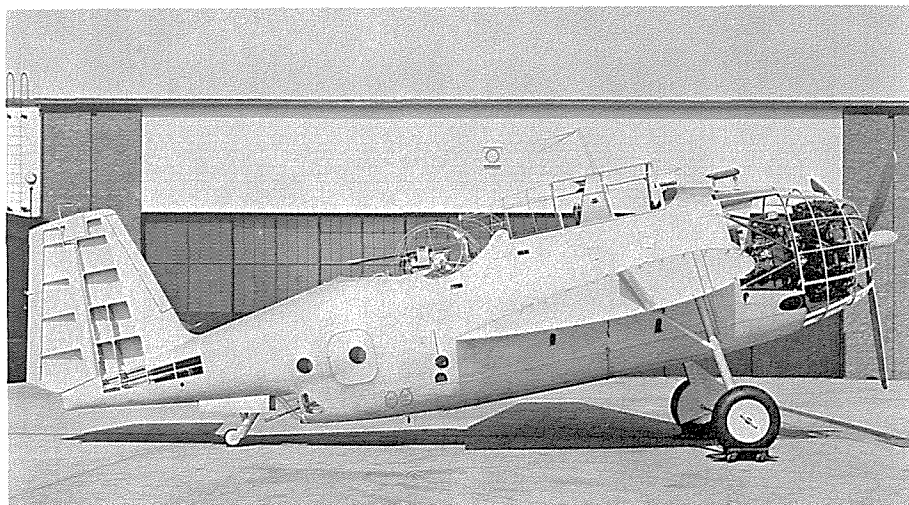
Another unusual feature was the off-

center machine gun mounting. This permitted the gunner, sight and gun to move in azimuth and elevation while providing an unobstructed field of view. The dome rotated in azimuth but remained stationary in elevation; the gun barrel protruded through a slot in the Plexiglas to allow the gunner and gun to move in elevation. Sight and gun were harmonized (aligned) to permit the lines of sight and gunfire to converge at a point 1,000 yards from the turret.

Entry could be achieved by unlatching and swinging down a large flap of $\frac{1}{4}$ -inch armorplate hinged to the bottom of the gunner's seat. The 48"-diameter turret ball was compact, though a great deal roomier than the Sperry lower ball turrets. The contoured gunner's seat was mounted alongside the gun; the gunner's feet rested on a footrest welded to the flap of armorplate (which was pulled up and latched shut following entry). Connections for interphone and oxygen hose were provided, as well as a seat belt.

Additional armor protection included $\frac{1}{2}$ -inch-thick plate in the front and sides of the turret, and $1\frac{1}{2}$ -inch-thick bulletproof glass to protect the gunner's face.

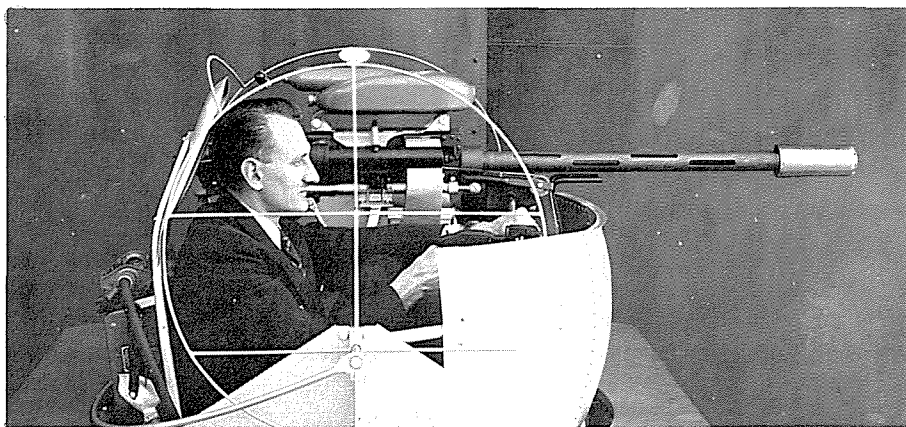
To guard the plane from beam, overhead and tail attacks, the turret could be rotated a full 360° in azimuth, and the gun could be raised in elevation 85° above horizontal and depressed 30° below horizontal on the beam. Due to the configuration of the TBF's canopy and rear decking, the gun had to be raised to clear the canopy when firing forward from one side to the other. A contour follower prevented the gun barrel from striking any part of the fuselage, and some TBFs and TBMs had cut-down rear fuselage decking to permit a wider field of fire (the turret gun would often be used to supplement a fixed .50-cal. gun when the



Mock-up of XTBF-1 at Grumman plant, Bethpage, Long Island, N.Y., early 1941. The mocked-up turret was included as an integral part of the aircraft. (Grumman)

Gunner in turret mock-up, showing extreme right-side downfire. Gunfire interrupters were provided to prevent gunner from shooting up his own plane. Note telescopic sight, flash suppressor on gun muzzle. (Grumman)

Turret mock-up showing extreme forward upfire position. The gunner's seat was fixed to follow gun movement. (Grumman)



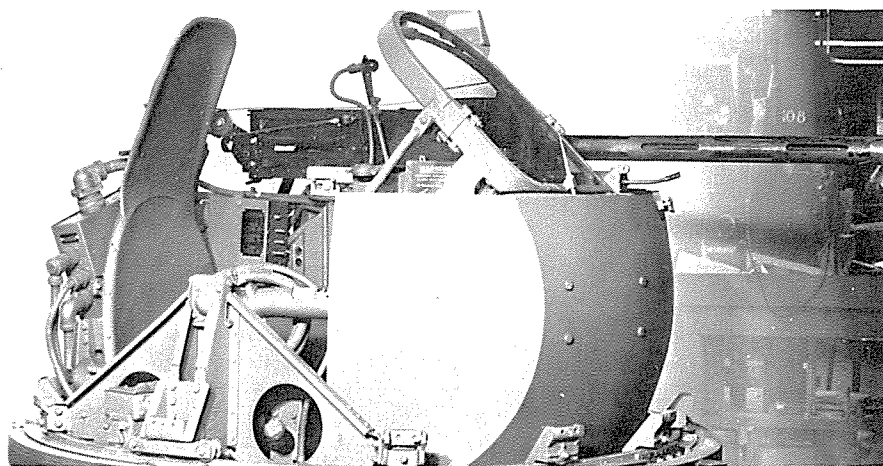
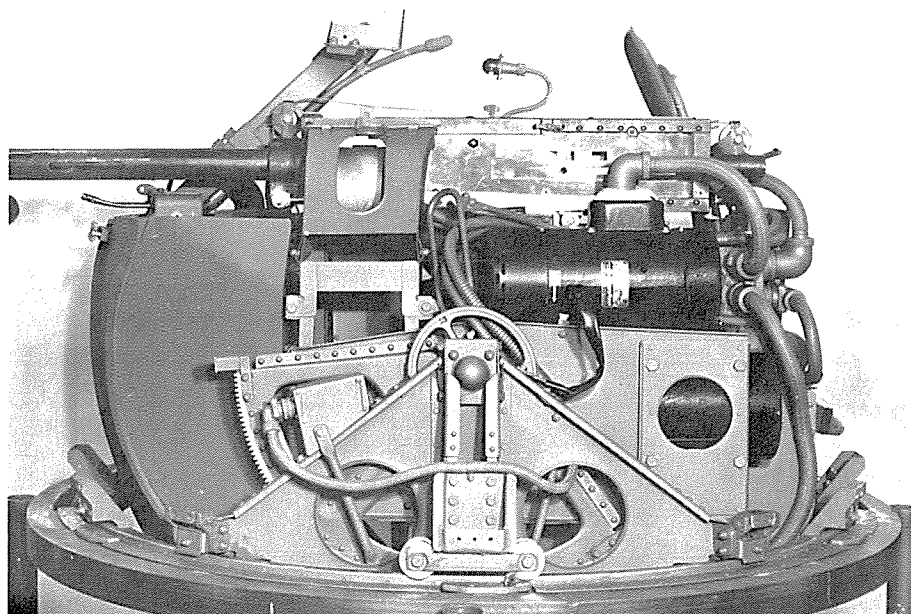
plane was on strafing attacks).

The turret was driven in azimuth by a large ring gear, engaged by a small gear wheel which in turn was attached to an electric motor run by the aircraft generators. Elevation motion was provided by a similar combination, a motor-driven gear wheel engaging a segment gear. Two amplidynes stepped up the aircraft's electric power, and determined the speed and direction of azimuth and elevation movements. Clutches, handcranks and gearboxes provided means of manual operation for maintenance or harmonization of sight and gun. There were no provisions for manual gun firing on the 150SE-1; the 150SE-2 featured a manual firing trigger.

Another unconventional feature of the turret-drive system was the employment of a pistol-grip type control handle, as opposed to the use of two-handed control handles on almost all other aircraft turrets. This control grip contained a thumb-operated high-speed slewing and elevation switch, an electric gun trigger switch, and a gun safety switch. The gunner's left hand was free for charging the gun or to clear jams. The control grip was at the end of a short rod coming out of a control box; movement of the grip to the left or right or up and down determined the direction in which the turret moved. The speed of both azimuth and elevation or depression movement was proportional to the deflection (from neutral) of the control grip; a minimum velocity of half a degree per second in either azimuth or elevation motion could be maintained. Normal elevation speed was 12° per second. High speeds in both dimensions were 30° per second in azimuth, and 45° per second in elevation.

A "dead man" feature of the control unit caused the turret to return to a neutral position when the grip was released, with the gun pointing aft and parallel to the aircraft centerline.

A single .50-caliber M2 machine gun was mounted to the gunner's left in the turret, above his shoulder. It was fastened to a Bell recoil adapter, and could be charged manually by means of a short charging handle in front of the gunner's left knee on the 150SE-1; the 150SE-2 featured a longer charging lever in the same position. A Mk. 9

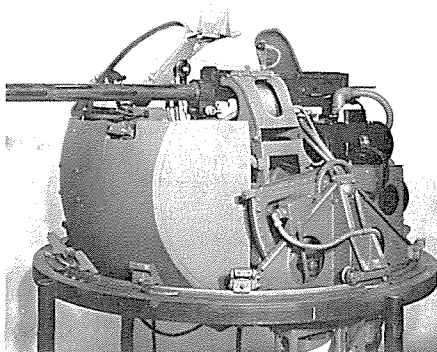


Turret operating mechanism in engineering test stand. Note simplicity and cleanliness of design. Early gun camera is mounted atop machine gun. (Grumman)

Turret with dome removed, showing left side. Note elevation quadrant, amplidyne motor-generator. (GE)

Right-side view of turret, showing gunner's seat, armor glass sighting panel (reflector sight attached at this time). GE electric power drive was one of first used on an American Navy aircraft turret. (GE)

Front view of turret, showing armored gunner's enclosure, elevation quadrant, amplidyne motor-generator. (GE)



electric optical reflector sight was provided behind a small pane of bullet-proof glass; a Mk. 11 ring-and-bead sight was included as an auxiliary sight for use in event of electrical failure. A fire interrupter switch—operating from a profile cam—prevented gunfire into the wings and tailplanes.

Two hundred rounds of belted ammunition were carried in a canister located directly under the gun. Linked cartridges were run up from this can into the left side of the receiver. Empty links were ejected into a short chute on the right side of the gun, where they dropped (along with expended cartridge casings) into another container almost directly under the gun. This container could be emptied into a canvas bag whenever a new ammunition can was fitted to the gun. A second 200-round can could be carried, but it had to be loaded from outside the turret (presumably by the radio operator-bombardier in the fuselage below and adjacent to the turret).

No ammunition booster was included, as the distance the shells had to be lifted was short enough to permit normal unassisted recoil feed.

Wounded turret gunner Kenneth Bratton being removed from his TBF aboard *USS Saratoga* following a carrier strike against Japanese warships at Rabaul Harbor, New Britain, in November 1943. This is an excellent illustration of how a casualty could be removed via the turret escape hatch. (NA 80-G-415477)

Rear view of turret mechanism, showing gun mount, charging cable, gunner's seat, armor glass (reflector sight mount is also shown). Note how gunner is offset to right of gun. (GE)

Interior of Grumman 150SE-2 turret on a TBM-1C at NAS Patuxent River, Maryland, June 1944. Note open escape hatch, trigger grip in stowed position, reflector gunsight, armor glass, gun charging cable. There were a few minor differences between the models 150SE-1 and the 150SE-2. (NA 80-G-233016)

ABOUT THE AUTHOR

The preceding material was excerpted from the author's work-in-progress, *American Aircraft Turrets & Flexible Gun Mounts, 1916-1960*, and encyclopedic history and directory of defensive airborne fire-control systems developed by the United States. It describes and depicts the activities and equipment of 10 major producers, and a score of minor manufacturers. A photogallery of World War II-vintage hand-held aircraft gun mounts completes the volume.

Mr. Hansen, his wife Eleanor, and their multitudinous columbiformes currently reside in Sunnyvale, California.

